

## **BROWNWATER LEVEE FOREST (HIGH LEVEE SUBTYPE)**

**Concept:** Brownwater Levee Forests are forest communities of natural levee deposits along brownwater Coastal Plain rivers, with a significant component of the suite of levee tree species: *Fraxinus pennsylvanica*, *Celtis laevigata*, *Platanus occidentalis*, *Betula nigra*, *Acer negundo*, and *Ulmus americana*. The High Levee Subtype covers the communities of the highest levees, in the inner to middle Coastal Plain stretches of rivers, where species of rich soils and marginal wetland species are a significant component. *Aesculus sylvatica*, *Lindera benzoin*, *Laportea canadensis*, *Nemophila aphylla* (= *Nemophila microcalyx*), and *Corydalis flavula* are examples of such species.

**Distinguishing Features:** Brownwater Levee Forests usually are easily distinguished by their location adjacent to Coastal Plain Brownwater Rivers. The wide levees on the Roanoke River may extend up to a mile from the river, but those on all other rivers are proportionally smaller. Levee Forests are distinguished from Bottomland Hardwoods communities by having a significant component of the suite of levee species that includes *Fraxinus pennsylvanica*, *Celtis laevigata*, *Platanus occidentalis*, *Betula nigra*, *Acer negundo*, and *Ulmus americana* in natural condition. (Heavily disturbed Brownwater Bottomland Hardwoods may be invaded by some of these species, particularly *Platanus* and *Betula*. *Liquidambar styraciflua* and various bottomland oaks may occur in Levee Forests but in smaller proportions than in Bottomland Hardwoods. Brownwater Levee Forests, especially this subtype, are similar to Piedmont Levee Forests, sharing much flora but showing differences in dominance and some regional differences. They can be distinguished readily by location. The abiotic dynamics of flooding and sediment deposition are significantly different, but examples in the Fall Zone may be difficult to place.

The High Levee Subtype is distinguished from the Medium Levee Subtype by the presence of characteristic drier site species, many of them shared with Piedmont Levee Forest. These include *Aesculus sylvatica*, *Lindera benzoin*, *Laportea canadensis*, *Nemophila aphylla* (= *Nemophila microcalyx*), and *Corydalis flavula*. There is a progression from the High Levee to Medium Levee to Low Levee Subtype as you move downstream, but large upstream levees also can have zoned vegetation. High levees sometimes drop off rapidly to sloughs or backswamps, but in other places have a broad zone of Medium Levee or even Low Levee on the side away from the river.

**Synonyms:** *Celtis laevigata* - *Fraxinus pennsylvanica* - *Acer negundo* - (*Juglans nigra*) / *Asimina triloba* / *Carex grayi* Forest (CEGL004740).

Ecological Systems: Atlantic Coastal Plain Small Brownwater River Floodplain Forest (CES203.250). Southern Atlantic Coastal Plain Large River Floodplain Forest (CES203.066).

**Sites:** Brownwater Levee Forests occur on natural levee and point bar deposits along channels of rivers draining from the Piedmont. They may occasionally occur on recently abandoned channel segments farther from the active river. The High Subtype is limited to the inner and occasionally middle Coastal Plain.

**Soils:** Soils are coarse-textured alluvial soils, with little horizon development because of relatively recent deposition. Most levees are mapped as Chewacla (Fluvaquentic Dystrudept) or Congaree (Oxaquic Udifluent).

**Hydrology:** The High Levee Subtype is intermittently or seasonally flooded, generally only for short periods. Soils are well drained when not flooded. The high microrelief of these levees leads to substantial variation in hydroperiod, though only very limited areas are very wet. Brownwater rivers, in contrast to blackwater, tend to have periods of sustained high flow, usually in winter and spring, where not controlled by dams. However, floods seldom remain deep enough to submerge higher levees for long periods.

**Vegetation:** Brownwater Levee Forests are naturally closed forests punctuated by canopy gaps. In the High Levee Subtype, the canopy is a varying mix, with *Celtis laevigata*, *Fraxinus pennsylvanica*, *Acer negundo*, *Platanus occidentalis*, and *Liquidambar styraciflua* most abundant. Other frequent or occasionally abundant canopy species include *Quercus pagoda*, *Carya cordiformis*, *Ulmus americana*, *Quercus laurifolia*, *Quercus michauxii*, *Pinus taeda*, *Juglans nigra*, and *Carya ovata*. The understory generally is dominated by *Acer negundo*, *Asimina triloba*, and *Carpinus caroliniana*, along with canopy species. *Ilex opaca*, *Crataegus viridis*, *Ulmus alata*, *Acer floridanum*, or *Morus rubra* may also be present. The shrub layer is usually well developed and may be dense. Frequent abundant species are *Lindera benzoin*, *Aesculus sylvatica*, *Ilex decidua*, and *Arundinaria tecta*. Woody vines are abundant and diverse, with *Muscadinia rotundifolia*, *Vitis aestivalis*, *Toxicodendron radicans*, *Parthenocissus quinquefolia*, *Smilax rotundifolia*, and *Smilax bona-nox* often abundant. *Berchemia scandens*, *Bignonia capreolata*, *Campsis radicans*, *Hydrangea (Decumaria) barbara*, and *Smilax hispida* may also be abundant. The herb layer is usually dense and often rich. Widespread levee species such as *Boehmeria cylindrica*, *Leersia oryzoides*, *Elymus hystrix*, *Elymus canadensis*, *Elymus riparius*, *Chasmanthium latifolium*, *Carex grayi*, *Nemophylla aphylla*, and *Viola* spp. are often abundant. Also present are species shared with rich mesic sites, such as *Laportea canadensis*, *Persicaria virginiana*, *Asarum canadense*, *Circaea canadensis*, and *Amphicarpaea bracteata*. Other species found in plot studies (Rice and Peet 1997, Rice et al. 2001, Faestel 2012) at moderate-to-high frequency include *Carex crebriflora*, *Carex abscondita*, *Carex amphibola*, *Commelina virginica*, *Leersia canadensis*, *Poa cuspidata*, *Saururus cernuus*, *Gonolobus suberosus* var. *suberosus*, *Carex louisianica*, *Sanicula canadensis* var. *canadensis*, *Arisaema triphyllum*, *Arisaema dracontium*, and *Dicliptera brachiata*. Invasive exotic species are often abundant in the herb and shrub layers, particularly *Ligustrum sinense*, *Lonicera japonica*, *Microstegium vimineum*, and *Stellaria media*. The epiphyte *Tillandsia usneoides* may have high cover, and *Pleopeltis michauxiana* may cover trunks and branches of some trees.

**Range and Abundance:** Ranked G3G5. The uncertainty in the G-rank may be at least partly because of confusion in the NVC between several associations of Coastal Plain and Piedmont natural levees.

**Associations and Patterns:** Brownwater Levee Forest occurs as linear bands along most of the river frontage on the brownwater rivers. The High Subtype predominates along the river in the upper Coastal Plain reaches. It grades to other floodplain communities behind. Well-developed examples of the Medium Levee Subtype may occur if the back slope of the levee is broad, but in other places levees slope rapidly into Cypress–Gum Swamp. Occasional segments of Brownwater Levee Forest may adjoin upland communities along bluffs or may occur along sloughs away from

the river channel. Sand and Mud Bar communities may occur below the levee, on the edge of the river channel.

The High Levee Subtype grades downstream to the Medium Levee Subtype as natural levee deposits become lower. It grades upstream to Piedmont Levee Forest.

**Variation:** No variants are recognized. Examples may vary substantially in composition of the canopy, with any of a substantial pool of species dominating. There are some differences observable among the different brownwater rivers, and these may lead to definition of variants in the future. There are differences in development between large and small rivers. In addition, the Cape Fear River differs from other North Carolina rivers in having a deeply entrenched channel. Communities recognizable as Brownwater Levee Forest occur 30 feet or more above the river but are distinct only in a narrow band.

**Dynamics:** Flooding is of brief duration but may be energetic enough to scour the soil surface, cause substantial movement of organic debris, or batter trees with floating debris. Alluvial deposition is naturally heaviest in this community; though still generally just a thin layer of sediment in any given flood, it brings in substantial nutrient subsidies.

Canopy gap dynamics typical of most floodplain forests apply, but levee forests may be somewhat more dynamic. They may be subject to more frequent wind disturbance because of their exposure to the open river channel and their low-density soils. They are most exposed to water disturbance as well, including development of new areas on aging point bars, erosion by cut banks, and local scouring by floods. Given the slow migration of channels under present conditions, most examples are long-established, but some patches represent late stages of primary succession.

**Comments:** The NVC classification of associations have been somewhat confusing, as associations were defined in local studies of different major rivers but not addressed to the intervening areas. The large species pool and variation in canopy dominants potentially allows a large range of associations to be defined, which may not be meaningful.

*Platanus occidentalis* - *Celtis laevigata* - *Fraxinus pennsylvanica* / *Lindera benzoin* - *Ilex decidua* / *Carex retroflexa* Forest (CEGL007730) is another NVC association which appears to be redundant with this.

*Pinus taeda* - *Fraxinus pennsylvanica* - *Ulmus americana* - *Celtis laevigata* Temporarily Flooded Forest [Provisional] (CEGL007559), previously treated as a separate High Pine subtype, is no longer recognized in the 4<sup>th</sup> approximation or in the NVC. *Pinus taeda* is one tree component that may or may not be present and may sometimes codominate.

There is concern in these communities about excessive sediment deposition caused by anthropogenically-induced erosion in the watersheds over the last several centuries. While this is a concern in all brownwater and Piedmont rivers, it has affected the High Levee Subtype more than others because this is the site of the heaviest sediment deposition. Excess sediment deposition may have raised ground levels, reduced flood frequency and duration, and probably altered plant composition. On the best-studied river in North Carolina, the Roanoke, the flood regime is also

altered by dams. This makes determination of the natural state difficult, and our understanding of these communities may need revision in the future.

**Rare species:**

Vascular plants: *Urtica chamaedryoides*, *Enemion biterntum*, *Trillium sessile*, and *Carex jamesii*.

Vertebrate animals: *Setophaga cerulea*.

**References:**

Faestel, M. 2012. Classification and description of alluvial plant communities of the North Carolina Coastal Plain. M.S. thesis, University of North Carolina, Chapel Hill.

Rice, S.K., R.K. Peet, and P. Townsend. 2001. Gradient analysis and classification of the forests of the lower Roanoke River floodplain, North Carolina: a landscape perspective. Unpublished manuscript.

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